

# Soft-Story Residential Buildings: A Statewide Perspective on Collapse Risk

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# What is the Seismic Safety Commission?

- Public Policy Advisors
- Independent appointees of Governor & Legislature
- 18 Multi-disciplinary Commissioners appointed by Governor
- 4 Local government representatives
- One Senator, One Assemblyman
- 5 Staffmembers



# Common Type of Housing



Open Front, Fewer Walls  
"Soft Story"



Collapse Crushing Cars





# Loss of Life, Housing, Income





# Housing Losses in Recent “Strong” EQ’s

- 1989 Loma Prieta EQ in S.F. Bay Area:
  - 7,700 Vacated Apartment Units
- 1994 Northridge EQ: (3% of LA’s Housing)
  - 16 lives lost in Northridge Meadows Apts
  - 34,000 multi-family units in LA region vacated
  - 17 “Ghostowns”: vacant apt & condo complexes





# Loss Estimates For Future "Major" EQ's

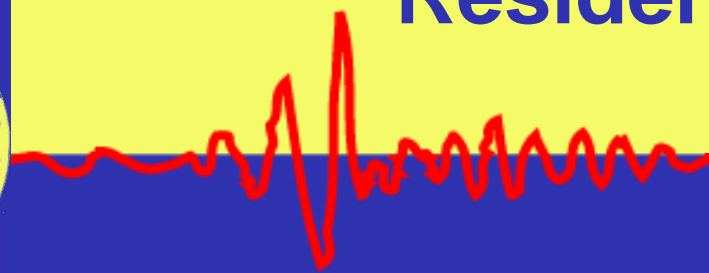
- Two thirds of future housing losses expected in multi-unit apartments
- 150,000+ housing units estimated for future metropolitan earthquakes in CA
- 360,000+ people would relocate

## Compare Hurricane Katrina:

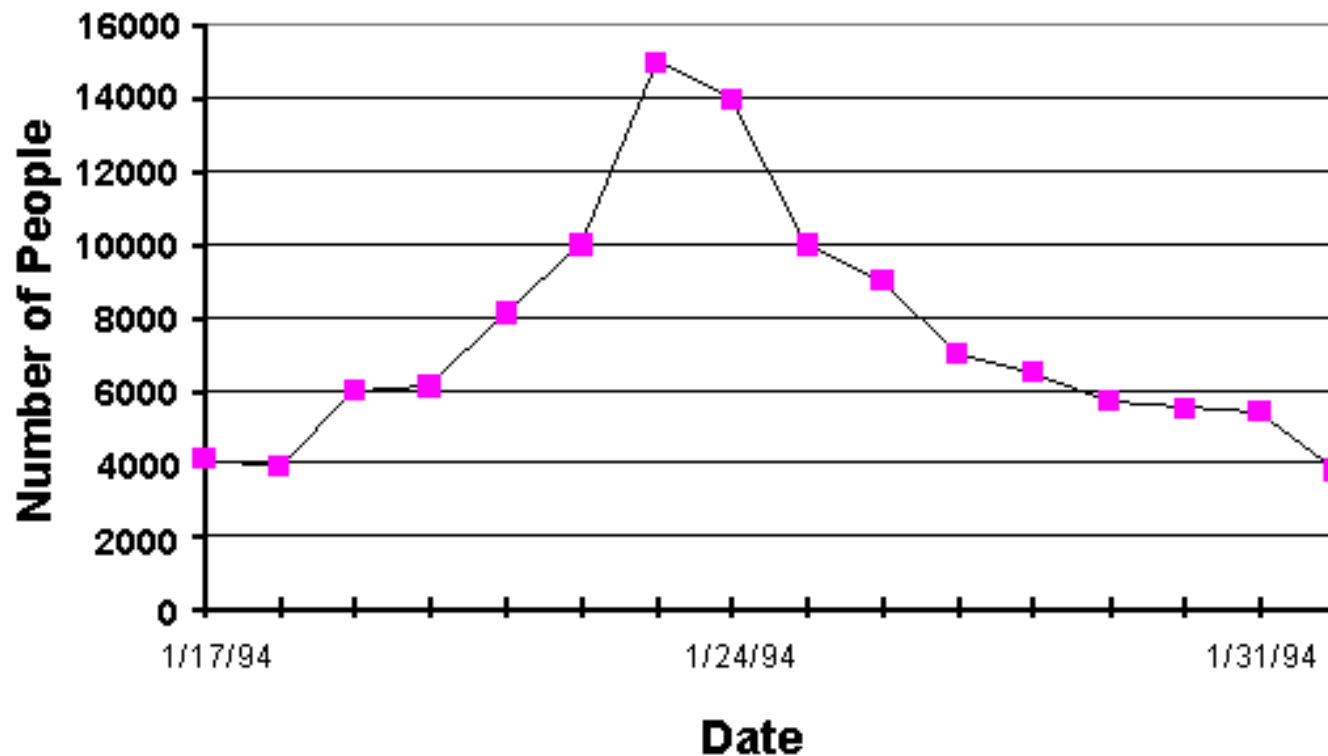
500,000 housing units damaged or destroyed



# Residents in Emergency Shelters



**NORTHRIDGE EARTHQUAKE**  
Number of People Staying in Shelters

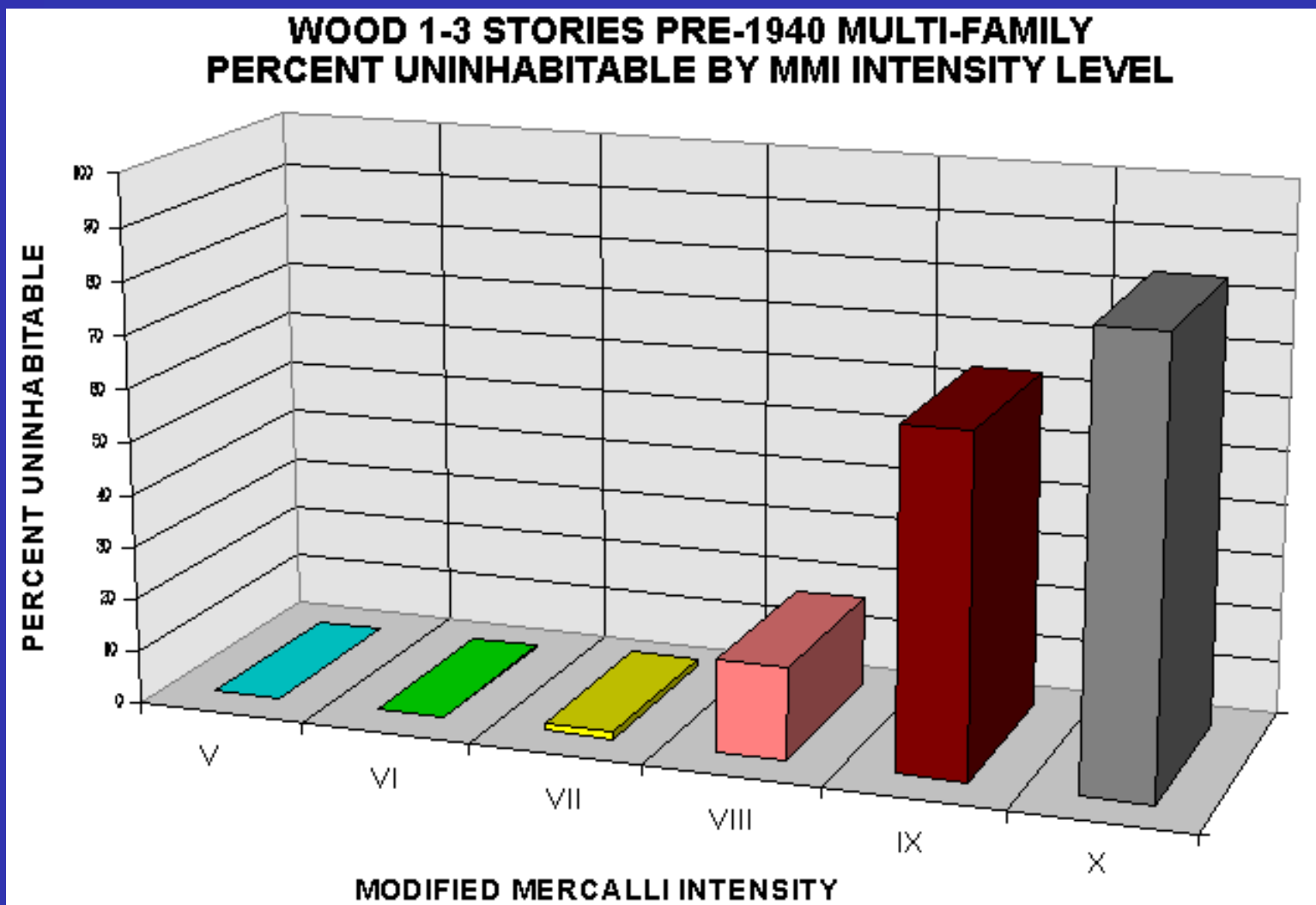


Source: American Red Cross



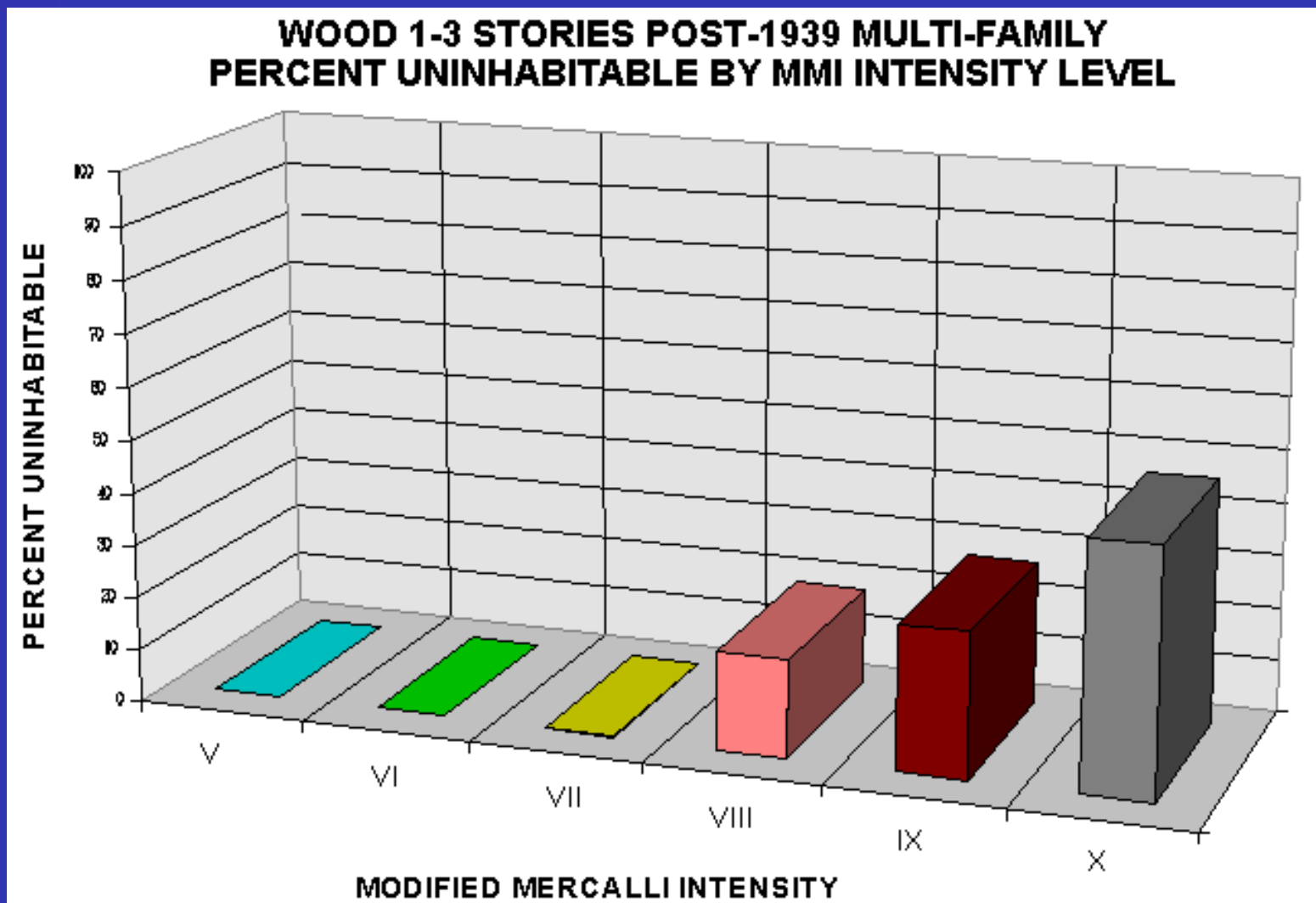


# Uninhabitable vs. Shaking Intensity, Pre-1940





# Uninhabitable vs. Shaking Intensity, Built after 1939





# 1994 Northridge Earthquake Shaking Intensity

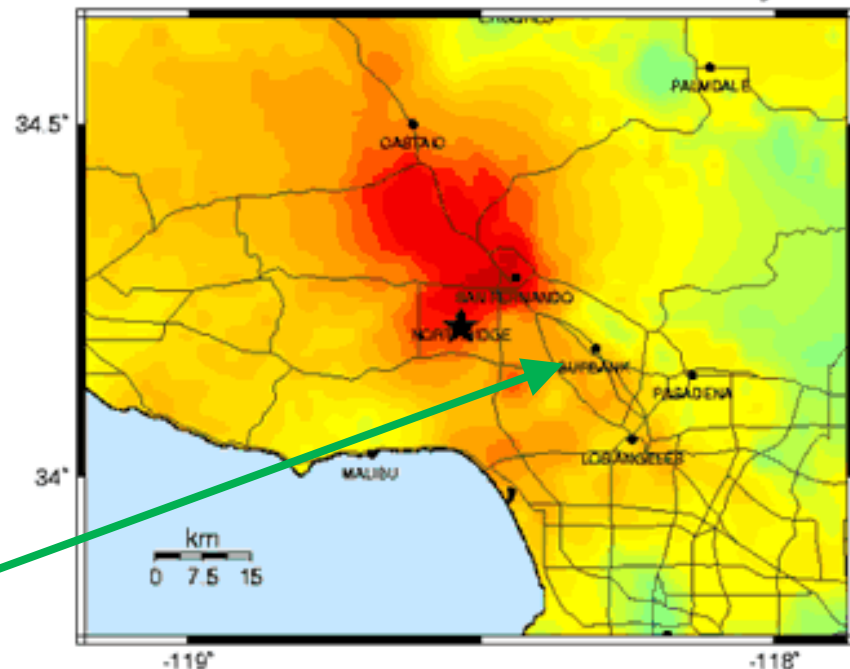
1994 Northridge  
quake  
M 6.7

Note offset of main  
damage to north  
of epicenter

***Burbank Dodged  
The Bullet***



TriNet Rapid Instrumental Intensity Map for Northridge Earthquake  
Mon Jan 17 04:30:55 AM PST M 6.7 NS4.21 W118.54 ID:Northridge



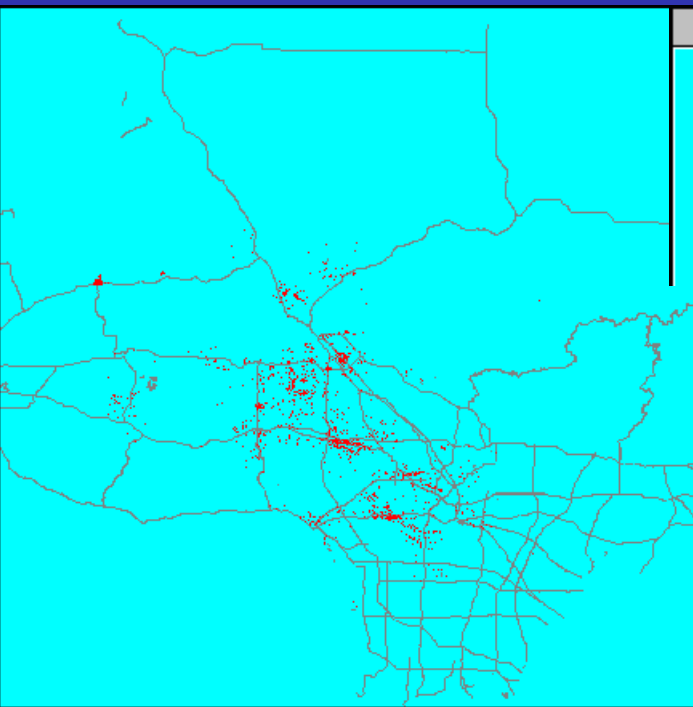
PRODUCED: Tue Jul 26 02:36:07 PM PDT, Produced by ShakeMap V2

PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC (%g)	<.17	.17-.4	.4-.3.9	3.9-9.2	9.2-18	18-34	34-66	66-124	>124
PEAK VEL (cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-66	66-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+



# Time to Repair & Replace Damaged Housing

- Northridge Red & Yellow Tag Apt Bldgs:
  - 50 percent back in use in 3 years
  - 98 percent back in use in 5 years



## UNINHABITABLE HOMES

Northridge Earthquake  
Magnitude 6.7

■ Red-Tagged Homes  
and Condos/Apts.

— Highways

Source: ABAG, 1996  
"Shaken Awake!"

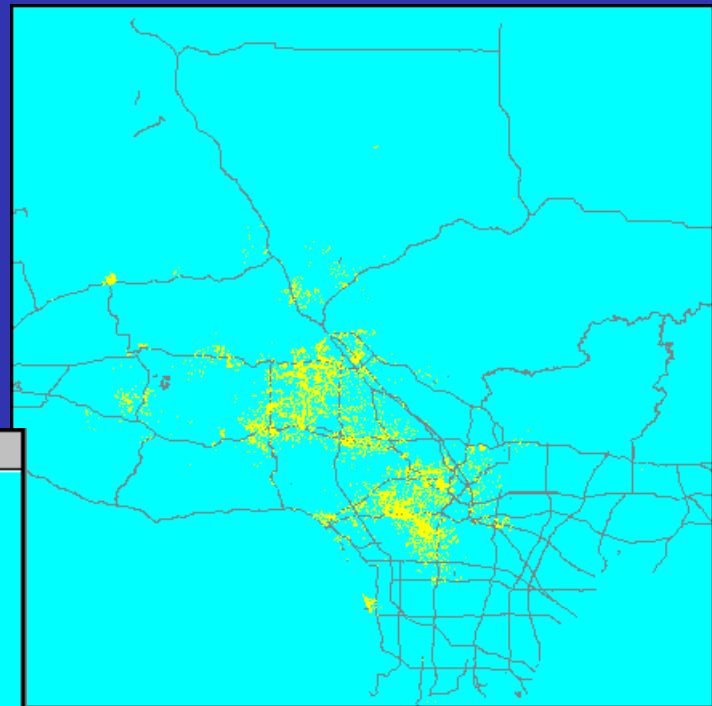
## UNINHABITABLE HOMES

Northridge Earthquake  
Magnitude 6.7

■ Yellow-Tagged  
Condos/Apts.

— Highways

Source: ABAG, 1996  
"Shaken Awake!"





# State Law on Soft Story Bldgs

AB 304 (Hancock) enacted in 2005:

- Supported by:
  - California Building Officials
  - CA Seismic Safety Commission
  - Association of Bay Area Governments
- Sponsored by: City of Berkeley
- Health & Safety Code 19160 – 19168  
[www.leginfo.ca.gov](http://www.leginfo.ca.gov)



# State Law on Soft Story Bldgs

- Soft Story Buildings constructed before 1978 may:
  - Create dangerous conditions
  - Threaten trapped occupants
  - Ignite fires
  - Threaten neighborhoods
  - Create disproportionate burdens on poor, elderly, young populations

H&S Code 19160 – 19168



# State Legislative Intent

- Encourage Cities and Counties to reduce collapse risk in soft story bldgs
  - Identify collapse-risk buildings
  - Adopt retrofit standards, preferably nationally-recognized standards
  - Provides flexibility to local governments
  - Provides a 15-year “halo” for buildings that are retrofitted

H&S Code 19160 – 19168





# Local Government Initiatives/Pioneers

- Fremont – Requires Retrofits
- Santa Monica – Required Retrofits, undergoing amendments
- Berkeley – Requires Evaluations, warning placards
- Los Angeles – Voluntary Strengthening
- San Francisco, Santa Clara County, San Jose – undertook inventories



# Federal/State Policies and Laws

- Federal Disaster Mitigation Act of 2000
- Requires Mitigation Goals/Priorities
- CA's Multi-Hazard Mitigation Plan:
  - Earthquake Risk Reduction a top priority
  - Lists Multi-Unit Residential Buildings as a priority for reducing collapse risk
  - 130,000 bldgs with 2+ million units
  - 46,000 soft story bldgs 730,000+ units

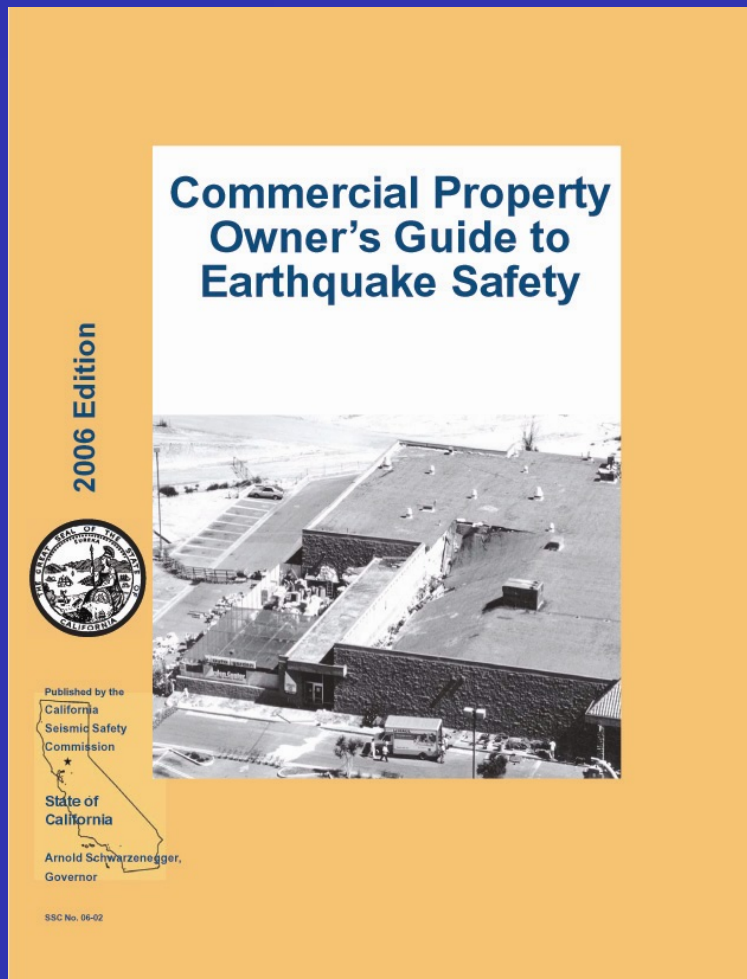


# Seismic Safety Commission Recommendations

- Local Mandatory Retrofit Ordinances
- Adopt Appendix Chapter A4,  
International Existing Building Code:  
*“Earthquake Hazard Reduction in Existing  
Wood-Frame Residential Buildings with Soft,  
Weak, or Open-Front Walls”*



# Disclosure at Time of Sale



[www.seismic.ca.gov/pubs](http://www.seismic.ca.gov/pubs)

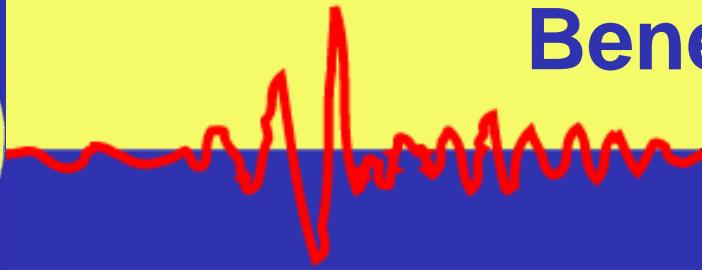


# Commercial Property Owner's Guide to Earthquake Safety

- Describes the soft story problem
- How owners and buyers can identify it
- How to fix the problem
  - Hire an architect or engineer
  - Design a retrofit
- Encourages owners to disclose to buyers all soft story conditions when buildings are sold



# Benefits to Public



- Fewer earthquake losses – lives, injuries, property, neighborhood integrity
- Less demand for emergency shelters
- Protect/prolong affordable housing
- Quicker recoveries after earthquakes



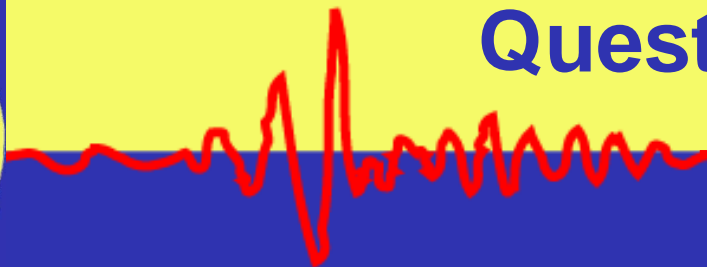
# Benefits to Owners

- Help reduce deaths, injuries and liability after future earthquakes
- Help reduce losses to rental income & investments
- Help extend building life





**Questions Welcome**



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Ali Sadre, Commissioner

CA Seismic Safety Commission